

October 13, 1989

MEMORANDUM FOR THE RECORD

FROM: Dean Nakano

SUBJECT: Geothermal Resources Council 1989 Annual Meeting, October 1-5, 1989, Santa Rosa, California, and Field Inspection of the ORMAT Stillwater and Steamboat Geothermal Power Plant Facilities, October 6-7, 1989, Fallon, Nevada

On October 1-5, 1989, Susumu Ono and I attended the Geothermal Resources Council 1989 Annual Meeting held in Santa Rosa, California. Attendees included Federal, State, and County agency representatives from California, Nevada, Arizona, Oregon, Utah, Idaho, New Mexico, and Washington, D.C., as well as individuals from Japan, New Zealand, Belgium, and Italy.

The annual meeting included technical sessions on the subject of geophysics, environmental issues, exploration, reservoir analysis, power generation, and geochemistry. (A copy of the program schedule listing the various sessions are attached.)

Some of the topics discussed which were of special interest are as follows:

- o Hawaii 500 MW Geothermal Project
- o Ambient Air Monitoring at The Geysers: A Historical Perspective and Current Status
- o Surface-Water Diversion Projects in The Geysers Known Geothermal Resource Area, Environmental and Engineering Constraints and Opportunities
- o Environmental Mediation and the Development of the Puna Geothermal Venture Project, Hawaii Tries a New Regulatory Process to Unlock a Decade of Confrontation
- o Experiments in Direct Use at Noi'i O Puna
- o Design of Steam Gathering Systems at The Geysers, A State-of-the-Art Review
- o Geothermal Drilling Fluids

Mr. Ono and I also attended speaking engagements by Joseph Aidlin, past chief council for Magma Power Company and pioneer developer at The Geysers, who spoke on the subject - "How Geothermal Energy Fits the Future", and Barbara Crowley, Vice Chairman of the California Energy Commission, who discussed - "The Present and Future Effect of Geothermal Development in California".

A special technical session was convened by Jerry Lesperance (DBED), Dr. Harry Olson (HNEI), and Dr. Don Thomas (HIG), to discuss the efforts and goals of the University of Hawaii's Scientific Observation Hole (SOH) Program, and to solicit ideas as to how the State should spend an additional appropriation of \$2.6 million dollars which is presently uncommitted to any specific

study.

Attendees at this session included representatives from the various RFP consortia, Bill Bohnett (HECO), Joe Iovenitti (Consultant to ERC Environmental and Energy Services Co.), Bill D'Olier (Consultant to HECO), Maurice Richard (PGV), Ralph Patterson, Jack Elbogen (Mid-Pacific Geothermal), Hank True (True Geothermal), Russ Alger (Campbell Estate), and numerous members of the geothermal industry. At the session, the following possible uses of the State appropriation for resource confirmation were identified:

- o Additional surface and airborne exploration surveys
- o Additional SOH type drilling projects with the capability for flow testing of the wells
- o Use of funds to "purchase" confidential well and flow test data from the commercial/private developers for use by the public domain
- o Support (through monetary compensation) of flow tests by private developers for future commercial wells in return for flow test data

Another meeting which Mr. Ono and I attended, concerned the implementation of a Geothermal Public Information Program, which was chaired by Susan Hodgson, Publication and Public Information Supervisor of the California Division of Oil and Gas. The purpose of the meeting was to discuss the development and sharing of public geothermal information and a solicitation of topics and types of information that should be included in this nationwide program. Much discussion was spent on the issue of environmental groups and the most important points that should be made to such groups and the general public.

On October 5, 1989, we participated in a one-day field trip of The Geysers Geothermal Area, which included a tour of well fields, power plants, and H₂S removal equipment and incinerators. Presentations were made on geology, civil engineering features, reservoir engineering, and power plant design and construction. (Photos of The Geysers field trip are attached.)

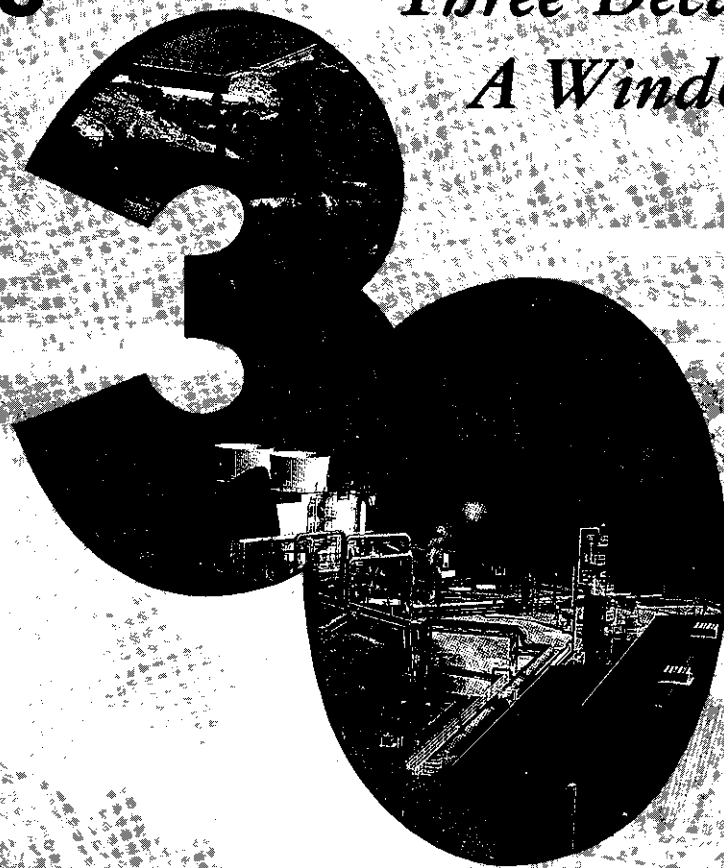
From October 6-7, 1989, Mr. Ono and I traveled to Reno, Nevada, where I was escorted by Mr. Austin Herrick, Deputy Project Manager, on a field trip to (2) ORMAT geothermal facilities. The power plants visited were the Stillwater and Steamboat facilities which both utilize an organic working fluid (isopentane) which is heated by hot geothermal fluids pumped from wells and subsequently re-injected back into the reservoir. The working fluid is vaporized and drives the turbine which is coupled to the generator. The exhaust vapor is subsequently condensed and is re-cycled back to the vaporizer. (Photos of both ORMAT facilities are attached.)

The tour of both facilities was most educational since the design of the proposed PGV facility on the island of Hawaii will utilize a somewhat similar process to generate electricity.

Sean

The Geysers-

*Three Decades of Achievement:
A Window on the Future*



Geothermal Resources Council
1989 Annual Meeting

1 - 4 October El Rancho Tropicana Hotel Santa Rosa, California

Program

1989 Annual Meeting Committee

With wholehearted thanks, the Council would like to acknowledge the dedicated efforts of the following individuals in organizing and ensuring the success of the 1989 annual meeting.

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VALLEY ENGINEERS, INC. • VIBRATION & NOISE ENGINEERING CORP.
VEIZADES AND ASSOCIATES, INC. • WILLIAMS TOOL CO. • WINZLER & KELLY

FIELD TRIPS

Field Trip No. 1

THE GEYSERS FIELD TRIP

Cost — \$45.00 per person — Maximum persons — 240

Thursday, 5 October

This trip will start at the hotel approximately 7:00 am and will return approximately 5:30 pm.

This will be one of the most comprehensive one-day field trips ever developed at The Geysers Geothermal Field. It involves the use of six buses divided into three units of two each. Each unit will leave the hotel approximately the same time, but they will take different routes through The Geysers. All of the buses will make the scheduled stops to hear presentations on various aspects, and when available, to inspect various facilities and areas. The specific presentations will be made by experts in their field and will include:

- 1. Geology and Geophysics
- 2. Civil Engineering Features
- 3. Drilling (tour)
- 4. Well Completion (tour)
- 5. Reservoir Engineering (Well testing, production and injection)
- 6. Power Plant Model and a Power Plant (tour)
- 7. H₂S Removal Equipment and Incinerators (tour), and
- 8. Environmental Features

Lunches and beverages will be carried on the buses and each unit (2 buses) will take lunch at a different site. It is advisable to wear comfortable casual clothes and a pair of good walking shoes. Sun screen and hats are optional but a camera is a **must item** if you want to have a photo record of this function.

Field Trip No. 2

SIGHTSEEING TOUR OF THE GEYSERS

Cost — \$45.00 per person — Maximum persons — 40

Thursday, 5 October

This trip will start at 8:00 am at the hotel and return at 4:00 pm.

This field trip is designed for spouses and friends of those who are attending the Field Trip No. 1 and those interested in a more general tour of The Geysers. It will emphasize the major facilities and features at The Geysers and will include an on board guide who will make presentations and answer questions. The trip will feature the following:

- 1. Presentation at vista point,
- 2. A drive by of major facilities and locations including the main Geysers area, several power plants and support facilities,
- 3. A presentation at the Little Geysers Fumarole area, and
- 4. A lunch and wine tasting at Chateau Souverain.

It is advisable to wear comfortable, casual clothes and a pair of good walking shoes. A camera would be a good optional item.

Field Trip No. 3

DIRECT-USE, NAPA AND LAKE COUNTIES

Cost — \$45.00 per person — Maximum persons — 20

Thursday, 5 October

This trip will start 7:00 am at the hotel and will return approximately 5:30 pm.

This field trip will emphasize the direct-use developments of geothermal energy in Sonoma, Napa and Lake Counties. Stops will include the city of Calistoga in Napa County, Harbin Hot Springs, and the recently dedicated Neasham Agricultural Park in Lake County. A winery stop will be made if time permits.

POSTER PRESENTATIONS

The Poster Presentation is scheduled from 11:30 am to 1:30 pm on Tuesday, 3 October in the Convention Center near the exhibits. All of the presentations will be manned by the author or the author's representative. Note this function will be held in conjunction with the Exhibitor's Luncheon.

Heat Flow Regime in The Geysers-Clear Lake Area of Northern California, U.S.A.: **Walters, M.**, GEO Operator Corp. and **J. Combs**

Future Air Quality Maintenance and Improvements-Through the Expanded Use of Geothermal Energy: **Goddard, W.B.**, Goddard & Goddard Engineering, **C.B. Goddard** and **D.W. McClain**

Computerized Monitoring Systems: **Goddard, W.B.**, Goddard & Goddard Engineering

The Orientation of Steam-Bearing Fractures at The Geysers Geothermal Field: **Thompson, R.C.**, Unocal Geothermal Division

Design of Steam Gathering Systems at The Geysers, A State-of-the-Art Review: **Veizades, H.**, Veizades and Associates and **W.J. Cain**

Particle Size Estimation and Analysis for Wellhead and Main-line Separators at Northern California Power Agency: **Halter, E.J.**, Vibration and Noise Engineering Corp. and **S. Eredy**

TPS: A Reservoir Monitoring Service: **Davarzani, J.**, Atlas Wireline Services and **T. Shwe**

Fracture Imaging in Geothermal Systems: **Suennicht, G.A.**, Unocal Geothermal Division, **C.A. Barton** and **P. Lysne**

Corrosion Monitoring at The Geysers Geothermal Field: **Farison, John**, Unocal Geothermal Division

The Magma Energy Exploratory Well: **Finger, J.T.**, Sandia National Labs., **Jacobson, R.D.**, **Ash, D.** and **Livesay, B.J.**

Interagency Cooperation on NEPA and CEQA: The Coso Case Study in Speed Permitting: **McClenahan, L.**, McClenahan, Hopkins and Associates and **C. Shepherd**

Geysers Reservoir Performance: **Barker, B.J.**, Unocal Geothermal Division, **M.S. Gulati**, **M.A. Bryan** and **K.L. Reidel**

1989 Annual Meeting Program Schedule

| Monday, 2 October 1989 | |
|------------------------|--|
| 7:00 am | Registration and Check-In — Convention Center Foyer |
| 7:00 am | Speaker's Continental Breakfast and Slide Testing — Vin-Rosé/Chablis Rooms |

OPENING SESSION — CONVENTION CENTER

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| 8:30 am | Welcome to the 1989 Annual Meeting — Jack Von Hoene , Committee Chairman, Geysers Geothermal Company |
| 8:40 am | Welcome and Recap of GRC Activities for 1989 — James Koenig , Geothermal Resources Council, President |
| 8:50 am | Announcements — David N. Anderson , Geothermal Resources Council, Executive Director |
| 9:00 am | The Geysers, Three Decades of Achievements — Dr. Carel Otte , Unocal Geothermal Division |
| 9:40 am | Questions and Answers |
| 9:50 am | The Geysers: Research and Development, It's Window on the Future — John E. Mock , U.S. Department of Energy |
| 10:15 am | Questions and Answers |
| 10:20 am | BREAK |
| 10:35 am | J. Michael Davis , Assistant Secretary Designate for Conservation and Renewable Energy, U.S. Department of Energy, has been invited to speak. |
| 10:55 am | Questions and Answers |
| 11:00 am | Hawaii 500 MW Geothermal Project — Gerald Lesperance , Department of Planning and Economic Development, State of Hawaii |
| 11:25 am | Questions and Answers |
| 11:30 am | Press Conference |
| 12:00 pm | JOSEPH W. AIDLIN LUNCHEON — Rainbow Room |

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| 8:00 am - 5:00 pm | GRC Office — Governors Suite |
| 8:00 am - 9:30 am | Guests Continental Breakfast — Cabernet Room |
| 9:30 am - 4:30 pm | Guest Sonoma Country Wine Tour — Meet Hotel Lobby |

1989 Annual Meeting Program Schedule

Monday, 2 October 1989

| TIME | GEPHYSICS SESSION <i>Mitch Stark</i> (Chairman), Unocal Geothermal Div. Gamay Room | ENVIRONMENTAL ISSUES AT THE GEYSERS <i>Roy Skinner</i> (Chairman), Harding Lawson Associates Chardonnay Room | EXPLORATION I <i>Joe Beal</i> (Chairman), Geysers Geothermal Co. Barbera Room |
|---------|---|--|--|
| 1:30 pm | Seismic Imaging for Velocity and Attenuation Structure in Geothermal Fields <i>Zucca, J.J.</i> , Lawrence Livermore National Lab. and <i>J.R. Evans</i> | Ambient Air Monitoring at The Geysers: A Historical Perspective and Current Status <i>Altshuler, S.L.</i> , Pacific Gas & Electric Company and <i>T.D. Arcado</i> | Geochemistry of Thermal Water from Selected Wells, Boise, Idaho <i>Mariner, R.H.</i> , U.S. Geological Survey, <i>H.W. Young, D.J. Parliman</i> and <i>W.C. Evans</i> |
| 1:55 pm | Surface to Borehole Electromagnetic Experiment at Roosevelt Hot Springs, A Feasibility Study <i>Tripp, A.C.</i> , University of Utah Research Institute, <i>H.P. Ross, J.A. Stodt</i> and <i>P.M. Wright</i> | Ambient Air Mercury Concentrations at The Geysers <i>Arcado, T.D.</i> , Pacific Gas & Electric Company and <i>S.L. Altshuler</i> | An Assessment of Geothermal Resources at Newcastle, Utah <i>Blackett, R.E.</i> , Utah Geological and Mineral Survey, <i>M.A. Shubat, D.S. Chapman, C.B. Forster</i> and <i>C.M. Schlinger</i> |
| 2:20 pm | Field Test Results of a Borehole Directional Radar <i>Chang, H.T.</i> , Sandia National Labs. | Environmental Characteristics and Occupational Hazards Associated with Abatement of Noncondensable Gases at The Geysers <i>Thind, P.S.</i> , Department of Water Resources, State of California | Recharge of Geothermal Fluids in the Great Basin <i>Buchanan, P.K.</i> , University of Nevada, Las Vegas |
| 2:45 pm | Mineralogy Evaluation in a Geothermal Well Using Statistical Probabilistic Log Evaluation Techniques <i>Quinn, T.H.</i> , Atlas Wireline Services, <i>N. Hashimoto, M. Suzuki</i> and <i>S. Takagi</i> | A Review of the Squaw Creek Aquatic Monitoring Program, The Geysers, California <i>Jordan, W.P.</i> , University of San Francisco and <i>R.J. Brown</i> | Alteration and Hydrothermal System Model of the San Kamphaeng Geothermal Area, Northern Thailand <i>Takashima, I.</i> , Akita University, Japan <i>S. Honda</i> and <i>M. Raksaskulwong</i> |
| 3:10 pm | BREAK | BREAK | BREAK |
| 3:25 pm | Stress in Geothermal Systems <i>Nielson, D.L.</i> , University of Utah Research Institute | Element Content of Rainbow Trout and Sacramento Sucker in Streams at The Geysers Region, California <i>Brown, R.A.</i> , University of San Francisco and <i>W.P. Jordan</i> | Geochemical Survey of the Llanura Tucumana Geothermal Area, Argentina <i>Iglesias, E.R.</i> , Instituto de Investigaciones Electricas, <i>A. Tineo, M. Duran, M. Verma, J. Garcia, R.M. Barragan</i> and <i>J.C. Falcon</i> |
| 3:50 pm | Fracture Imaging in Geothermal Systems <i>Suennicht, G.A.</i> , Unocal Geothermal Division, <i>C.A. Barton</i> and <i>P. Lysne</i> | Surface-Water Diversion Projects in The Geysers Known Geothermal Resource Area Environmental and Engineering Constraints and Opportunities <i>Sanford, R.A.</i> , Harding Lawson Associates | U-Th Disequilibrium Dating of Authigenic Calcites in The Mezawa (MZI-IIA) Geothermal Well Oregon <i>Hull, C.D.</i> , University of Oregon and <i>A.F. Waibel</i> |
| 5:15 pm | GEYSERS GEOTHERMAL ASSOCIATION RECEPTION | | |
| 6:30 pm | WINERY DINNER | | |

Special Meetings

Sunday, 1 October — 8:30 am to 12:00 pm
NATIONAL GEOTHERMAL ASSOCIATION (NGA)
BOARD OF DIRECTORS MEETING
Chenin Blanc Room

This meeting will cover the normal operating activities of the NGA and its Board of Directors.

Sunday, 1 October — 1:30 pm to 4:00 pm
GEOTHERMAL RESOURCES COUNCIL (GRC)
BOARD OF DIRECTORS MEETING
Green Hungarian Room

This meeting will cover the normal operating activities of the GRC and its Board of Directors.

Sunday, 1 October — 4:00 pm to 5:30 pm
1990 INTERNATIONAL SYMPOSIUM ON GEOTHERMAL ENERGY
Chenin Blanc Room
Meeting of the Organizing Committee.

Monday, 2 October — 1:30 pm to 5:00 pm
GEOTHERMAL RESOURCES ASSOCIATION (GRA)
Chenin Blanc Room

GRA, the governmental relations organization for the geothermal industry, is currently working on several state and federal legislative issues, maintaining PURPA benefits, strengthening tax benefits, extending federal lease terms and monitoring DOE appropriations.

Monday, 2 October — 4:30 pm to 6:00 pm
GEOTHERMAL DRILLING ORGANIZATION (GDO)
Green Hungarian Room

The Geothermal Drilling Organization cost shares geothermal drilling research projects with other industry members and/or the federal government. The meeting will include discussions of ongoing and proposed drilling research projects.

Tuesday, 3 October — 3:30 pm —
Riesling Room

Geothermal Public Information Forum. Initial organizational meeting. Ways GRC members can discuss and develop geothermal public information programs will be explored.

Wednesday, 4 October — 11:00 am to 12:00 pm
GEOTHERMAL TECHNICAL ORGANIZATION (GTO)
Green Hungarian Room

The Geothermal Technology Organization costs shares industry research projects with other industry members or the federal government. Attendees will discuss the recent organization of GTO, proposed research projects and the budget.

Thursday, 5 October — 8:00 am to 5:00 pm
Vin Rosé/Chablis Room
Geysers Research Meeting.

1989 Annual Meeting Program Schedule

Tuesday, 3 October 1989 (cont.)

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| 11:30 am | BUFFET LUNCHEON/POSTER PRESENTATION — EXHIBIT AREA | |
| | GEYSERS RESERVOIR EXPLOITATION I <i>John Council</i> (Chairman), Engineering Consultant Gamay Room | POWER GENERATION (Non-Geysers) <i>Murray Grande</i> (Chairman), Northern Calif. Power Agency Chardonnay Room |
| 1:30 pm | The Geysers: A Case of Middle Age Spread <i>Robinson, J.P.</i> , Unocal Geothermal Division | Application of the Kalina Cycle Technology to Power Generation <i>Kalina, A.I.</i> , Exergy, Inc. and <i>H.M. Liebowits</i> |
| 1:55 pm | A Systematic Approach to Decline Curve Analysis for The Geysers Steam Field, California <i>Sanyal, S.K.</i> , GeothermEx, Inc., <i>A.J. Menzies</i> , <i>P.J. Brown</i> , <i>K.L. Eneedy</i> , and <i>S. Eneedy</i> | Simple Strategies for Minimization of Cooling Water Usage in Binary Power Plants <i>Bliem, C.J.</i> , Idaho National Engineering Lab and <i>G.L. Mines</i> |
| 2:20 pm | The Role of Decline Curve Analysis at The Geysers <i>Eneedy, K.L.</i> , Geysers Geothermal Company | Optional Operational Pressure for a 55 MW Turbine Utilized in a Wet Steam Field <i>Mendez-Lopez, G.</i> , Instituto de Ingenieria, UABC, Mexico and <i>M. Quintero-Nunez</i> |
| 2:45 pm | Downhole Enthalpy and Superheat Evolution of Geysers Steam Wells <i>Eneedy, K.L.</i> , Geysers Geothermal Company | The Coso Geothermal Power Projects <i>Schoonmaker, J.L.</i> , Mission Power Engineering Company |
| 3:10 pm | BREAK | BREAK |
| 3:25 pm | Recovery of Injected Condensate as Steam in the South Geysers Field <i>Beall, J.J.</i> , Geysers Geothermal Company <i>S. Eneedy</i> and <i>W.T. Box, Jr.</i> | Comparison of Direct Contact and Kettle Reboilers to Reduce Noncondensables in Geothermal Steam <i>Duthie, R.G.</i> , Bechtel National Inc. and <i>M. Nawaz</i> |
| 3:50 pm | Effect of Condensate Reinjection on Steam Chemistry at The Geysers Field <i>Klein, C.</i> , GeothermEx, Inc. and <i>S. Eneedy</i> | Steam Purities of Geothermal Power Plants <i>Hibara, Y.</i> , Mitsubishi Heavy Industries, Ltd. <i>N. Hara</i> and <i>H. Sakanashi</i> |
| 4:15 pm | | Automatic on Line Mechanical Cleaning System for Condensers and Heat Exchangers <i>Someah, K.</i> , Water Services of America, Inc. |

6:30 pm Wine Tasting Class — Rainbow B Room
8:00 pm Wine Tasting Class — Rainbow B Room

Wednesday, 4 October 1989

7:00 am Speakers Continental Breakfast and Slide Testing — Vin Rosé/Chablis Room
 8:00 am Registration and Check-In Convention Center Foyer
 8:00 am - 5:00 pm GRC Office open — Governors Suite

| TIME | GEYSERS RESERVOIR EXPLOITATION II <i>Kathy Eneidy</i> (Chairperson), Geysers Geothermal Co. Gamay Room | GEYSERS PRODUCTION FACILITIES <i>Terry Kelley</i> (Chairman), Unocal Geothermal Div. Chardonnay Room | EXPLORATION II <i>Harrison Creecraft</i> (Chairman), Unocal Geothermal Div. Barbera Room |
|----------|--|---|---|
| 8:30 am | Geysers Reservoir Performance <i>Barker, B.J.</i> , Unocal Geothermal Division <i>M.S. Gulati, M.A. Bryan</i> and <i>K.L. Reidel</i> | Design of Steam Gathering Systems at The Geysers, A State-of-the-Art Review <i>Veizades, H.</i> , Veizades and Associates and <i>W.J. Cain</i> | Geology and Geothermal Potential of the Tecuamburro Volcano Area of Guatemala <i>Duffield, W.A.</i> , U.S. Geological Survey, <i>G.H. Heiken, K.H. Wohlets, L.W. Maassen,</i> <i>G. Dengo</i> and <i>E.H. McKee</i> |
| 8:55 am | Some Considerations on Resource Evaluation of The Geysers <i>Bodvarsson, G.S.</i> , Lawrence Berkeley Lab. <i>S. Gaulke</i> and <i>M. Ripperda</i> | A Survey of Computer Assisted Production Operations in The Geysers <i>Vestal, K.R.</i> , Systems Application Engineering, Inc. | Hydrogeochemical Exploration of the Tecuamburro Volcano Region, Guatemala <i>Goff, F.</i> , Los Alamos National Lab., <i>A.H. Truesdell, C.J. Janik, A. Adams,</i> <i>A. Roldan-M</i> and <i>K. Meeker</i> |
| 9:20 am | Economic Analysis of Steam Production at The Geysers Geothermal Field, California <i>Sanyal, S.</i> , GeothermEx, Inc. | An Overview of Geothermal Separators <i>Jung, D.B.</i> , Two-Phase Engineering and Research, Inc. | Geothermal Exploration of Ascension Island South Atlantic Ocean <i>Nielson, D.L.</i> , University of Utah Research Institute and <i>S.G. Stiger</i> |
| 9:45 am | Forked Wellbore Completions Improve Development Strategy <i>Yarter, R.E.</i> , Northern California Power Agency, <i>P.E. Cavote</i> and <i>D.G. Quinn</i> | Particle Size Estimation and Analysis for Wellhead and Mainline Separators at Northern California Power Agency <i>Halter, E.J.</i> , Vibration and Noise Engineering Corp. and <i>S. Eneidy</i> | An EC Project on Testing Geophysical Techniques for the Exploration of the Geothermal Field of Milos <i>Staroste, E.</i> , Commission of the European Communities |
| 10:10 am | | Description of an Operational Desuperheating and Chloride Scrub System, Aidlin Geothermal Project West Geysers, California <i>Bell, D.</i> , Mission Power Engineering | Comparison of Early Exploration at Platanares (Honduras) and Wairakei (New Zealand) <i>Truesdell, A.H.</i> , U.S. Geological Survey, <i>R.B. Glover,</i> <i>C.J. Janik, K.L. Brown,</i> and <i>F. Goff</i> |
| 10:35 am | BREAK | BREAK | BREAK |
| 10:50 am | Operational Aspects of Placing Proppant in a Naturally Fractured Geothermal Reservoir <i>Bennett, T.S.</i> , CSM Geothermal Project, United Kingdom and <i>K. Barker</i> | A Study of Orifice Plate Impulse Tubing Configurations for Steam Flow Measurements at The Geysers <i>Netzel, T.L.</i> , Geysers Geothermal Company | Scientific Core Hole Valles Caldera #2b (VC-2b), New Mexico: Drilling and Some Initial Results <i>Gardner, J.N.</i> , Los Alamos National Lab., <i>J.B. Hulen,</i> <i>P. Lysne, R. Jacobson, F. Goff, D.L. Nielson,</i> <i>L. Pisto, C.W. Criswell, R. Gribble, K. Meeker,</i> <i>J.A. Musgrave, T. Smith</i> and <i>D. Wilson</i> |
| 11:15 am | A Proposal for Deep Continental Scientific Drilling to Investigate a 400° C (750° F) Hydrothermal System on the Flank of The Geysers - Near Mt. Hanna <i>Fournier, R.</i> , U.S. Geological Survey | | The Sulphur Springs Hydrothermal System Past & Present, Initial Results from CSDP Corehole VC-2b, Valles Caldera, New Mexico <i>Hulen, J.B.</i> , University of Utah Research Institute, <i>J.N. Gardner, F. Goff, D.L. Nielson, J.N. Moore,</i> <i>J.A. Musgrave, M.M. Lemieux, K. Meeker</i> and <i>M.G. Snow</i> |

Tuesday, 3 October 1989

7:00 am Speakers Continental Breakfast and Slide Testing — Vin Rosé Room

7:30 am Registration and Check-In — Convention Center Foyer

| TIME | NATURE OF THE GEYSERS <i>Ken Williamson</i> , Unocal Geothermal Div., Chairman Gamay Room | ENVIRONMENTAL/ALTERNATE USE SESSION <i>Roland Sanford</i> , Harding Lawson Associates, Chairman Chardonnay Room |
|----------|--|--|
| 8:00 am | Heat Flow Regime in The Geysers-Clear Lake Area of Northern California, U.S.A. <i>Walters, M.</i> , GEO Operator Corp. and <i>J. Combs</i> | Future Air Quality Maintenance and Improvements - Through the Expanded Use of Geothermal Energy <i>Goddard, W.B.</i> , Goddard & Goddard Engineering <i>C.B. Goddard</i> and <i>D.W. McClain</i> |
| 8:25 am | Distribution of Oxygen Isotopes and Noncondensable Gas in Steam at The Geysers <i>Gunderson, R.P.</i> , Unocal Geothermal Division | The Coso Mohave Ground Squirrel Mitigation Program: A Case Study in Mitigation Planning for Cumulative Impacts <i>Hopkins, J.G.</i> , McClenahan & Hopkins Associates |
| 8:50 am | Structural Stratigraphy and Intrusive Rocks at The Geysers Geothermal Field <i>Thompson, R.C.</i> , Unocal Geothermal Division <i>Richard, M.A.</i> , Puna Geothermal Ventures <i>D.L. Carey</i> and <i>J.S. Russell</i> | Environmental Mediation and the Development of the Puna Geothermal Venture Project, Hawaii Tries a New Regulatory Process to Unlock a Decade of Confrontation |
| 9:15 am | Stratigraphic and Structural Controls of the Occurrence of Steam at The Geysers <i>McNitt, J.R.</i> , GeothermEx, Inc., <i>R.C. Henneberger</i> , <i>J.B. Koenig</i> and <i>A. Robertson-Tait</i> | Geothermal Sulfur, Marketing Strategies <i>Felperin, D.J.</i> , Pacific Gas & Electric Company |
| 9:40 am | The Nature of Steam Bearing Fractures in the South Geysers Reservoir <i>Beall, J.J.</i> , Geysers Geothermal Company and <i>W.T. Box, Jr.</i> | Precious Metals in the Salton Sea Geothermal Brines <i>McKibben, M.A.</i> , University of California, Riverside, <i>A.E. Williams</i> and <i>G.E.M. Hall</i> |
| 10:05 am | BREAK | BREAK |
| 10:20 am | The Orientation of Steam-Bearing Fractures at The Geysers Geothermal Field <i>Thompson, R.C.</i> , Unocal Geothermal Division and <i>R.P. Gunderson</i> | Applicability of Geothermal Silica from Cerro Prieto Field, for the Elaboration of Ceramic Pastes <i>Carpio-Obeso, M.P.</i> , University Autonoma de Baja California and <i>M.A. Campos-Rodriguez</i> |
| 10:45 am | The Correlation of Noncondensable Gas and Chloride in Steam at The Geysers <i>Haizlip, J.R.</i> , GEO Operator Corporation and <i>A.H. Truesdell</i> | An Analysis on Direct Uses of Geothermal Energy in Japan with Respect to Inlet Temperature and Flow Rate <i>Sekioka, M.</i> , National Defense Academy, Japan |
| 11:10 am | Petrographic and Fluid Inclusion Evidence for Past Boiling, Brecciation and Associated Hydrothermal Alteration Above the Northwest Geysers Steam Field, California <i>Moore, J.M.</i> , University of Utah Research Institute, <i>J.B. Hulen</i> , <i>M.M. Lemieux</i> , <i>J.N. Sternfield</i> and <i>M.A. Walters</i> | Experiments in Direct Use at Noi'i O Puna <i>Beck, A.G.</i> , Hawaii Energy Extension Service |

8:00 am - 5:00 pm GRC Office Governors Suite

7:00 am - 8:30 am Commissioner Barbara Crowley Breakfast — Rainbow Room

9:30 am - 4:30 pm Valley of the Moon Guest Wine Tour — Meet Hotel Lobby

1989 Annual Meeting Program Schedule

Wednesday, 4 October 1989 (cont.)

| 12:00 pm | AWARD AND BUSINESS MEETING LUNCHEON — Convention Center | | |
|----------|---|---|---|
| | POWER GENERATION AT THE GEYSERS <i>Mike Rogers</i> (Chairman), Pacific Gas & Electric Gamay Room | OPERATIONAL TECHNIQUES <i>Steve Burden</i> (Chairman), Geysers Geothermal Co. Chardonnay Room | GEOCHEMISTRY IN DEVELOPMENT <i>Jill Haizlip</i> (Chairperson), GEO Operator Corp. Barbera Room |
| 1:30 pm | The Evolution of Power Plant Engineering Design at The Geysers <i>Ballantine, D.B.</i> , Pacific Gas & Electric Company | Initial Response to Production and Reinjection at the Ohaaki Geothermal Field, New Zealand <i>Clotworthy, A.W.</i> , ElectricCorp Production, New Zealand, <i>B.S. Carey</i> and <i>L.G. Bacon</i> | The Solubility of Amorphous Silica in Geothermal Brines <i>Gallup, D.L.</i> , Unocal Corporation |
| 1:55 pm | Power Plant Operating Alternatives for Improving and Extending Reservoir Performance at The Geysers <i>Grande, M.G.</i> , Northern California Power Agency and <i>S.L. Eneedy</i> | Preproduction Analysis of Thermal Breakthrough by Reinjection at the Los Hornos First 5-MWe Units <i>Kruger, P.</i> , Stanford University, <i>M. Medina</i> and <i>A. Aragon</i> | A Thermodynamic Model for Predicting HCL Partial Pressure Above a High Temperature Hypersaline Geothermal Fluid <i>Andersen, G.</i> , Unocal Corporation |
| 2:20 pm | Design of Construction of the West Ford Flat Power Plant at The Geysers <i>Urbank, K.F.</i> , Geysers Geothermal Company | TPS: A Reservoir Monitoring Service <i>Davarzani, J.</i> , Atlas Wireline Services and <i>T. Shwe</i> | The Dixie Valley, Nevada Tracer Test <i>Adams, M.C.</i> , University of Utah Research Institute, <i>W.R. Benoit</i> , <i>C. Doughty</i> , <i>G.S. Bodvarsson</i> and <i>J.N. Moore</i> |
| 2:45 pm | Modular Design and Construction at the Bear Canyon 20 MW Power Plant <i>Phair, K.A.</i> , Stone & Webster Engineering Corp. | * Geothermal Drilling Fluids <i>Pantermuehl, R.</i> , M-I Drilling Fluids and <i>P. Scott</i> | Scaling of Geothermal Wells in in Cerro Prieto Field <i>Mercado S.</i> , Electrical Research Institute, Mexico and <i>F.J. Bermejo</i> |
| 3:10 pm | Operating Experiences of Converting a Stretford to a Lo-Cat (R) H ₂ S Abatement System at Pacific Gas & Electric Company's Geysers Unit 15 <i>Henderson, J.M.</i> , Pacific Gas & Electric Company and <i>G.P. Dorigi</i> | On the Performance Ball Check Valves <i>Hernandez-Galan, J.L.</i> , Instituto de Investigaciones Electricas, Mexico and <i>E. Buendia</i> | Calcium Carbonate Scale Control in Geothermal Wells <i>Vaska, M.</i> , Drew Industrial Division and <i>N. Kellogg</i> |
| 3:35 pm | BREAK | BREAK | BREAK |
| 3:50 pm | Weld Repair of Geothermal Turbine Rotors <i>Chaney, C.E.</i> , Pacific Gas & Electric Company | Laboratory and Field Evaluation of Polyurethane Foam for Lost Circulation Control <i>Glowka, D.A.</i> , Sandia National Labs, <i>G.E. Loeppke</i> , <i>P.B. Rand</i> and <i>E.K. Wright</i> | |



List of Exhibitors

1 - 4 OCTOBER 1989

EL RANCHO TROPICANA HOTEL
SANTA ROSA, CALIFORNIA



GEOTHERMAL RESOURCES COUNCIL

1989 ANNUAL MEETING

THE GEYSERS - THREE DECADES OF ACHIEVEMENT:
A WINDOW ON THE FUTURE
OCTOBER 1-4, 1989
EL RANCHO TROPICANA HOTEL
SANTA ROSA, CALIFORNIA

LIST OF EXHIBITORS

Booth Nos. 1 & 3
(outside) A-Z/GRANT INTERNATIONAL COMPANY
 P.O. Box 1231
 Healdsburg, CA 95448
 Jim Hanson
 Phone: 707/433-6969
 Facsimile: 707/433-0509

Geothermal drilling tools, rotating drilling head and geothermal wellhead
packer (valve changing tool).

Booth No. 47 AMERICAN LINE BUILDERS
 Route 2, Box 190
 Dayton, WA 99328
 D.J. Frame
 Phone: 509/382-4766
 Facsimile: 509/382-2443

Transmission power lines, distribution systems, electrical substations.

Booth Nos. 35 & 36 ANSALDO ABB COMPONENTI
 Via N. Lorenzi
 8 Genoa ITALY 16152
 Giovanni Gaino
 Phone: 39/10-6557411
 Facsimile: 39/10-6557648
 Telex: 270006

Booth No. 21

ASSOCIATED PIPING AND ENGINEERING COMPANY
11919 FM 529
Houston, TX 77041
David Murphy
Phone: 404/664-4464
Facsimile: 713/937-1011

Induction Pipe Bender. 3 machines (range 3" - 66" OD). Pipe Fabricator.
2 plants -- Clearfield, Utah and Houston, Texas.

Booth No. 16
(outside)

BALLEW TOOL COMPANY
P.O. Box 361
Cobb, CA 95426
Leon Ballew
Phone: 707/987-0837

Ballew Tool Company's Banjo Box (blow out equipment). Designed
specifically for Geothermal Development "Guaranteed" no down time!

Booth No. 8
(outside)

BARTON VALVE COMPANY
2401 North Highway 177
Shawnee, OK 74801
Mike Whatley
Phone: 405/273-7660
Facsimile: 405/275-6419
Telex: 9108313116

Barton Valve Company will display various products and information on
products offered in the valve, wellhead, services, instrumentation and
automation areas as they apply to geothermal applications.

Booth No. 48

BELILOVE COMPANY - ENGINEERS
P.O. Box 2057
San Leandro, CA 94577-0317
Carl Gutermann
Phone: 415/895-6186
Facsimile: 415/352-8748
Telex: 335406

Process controls & instrumentation to monitor and control pressure,
temperature, level, and flow.

Booth No. 37

BOYLES BROTHERS DRILLING COMPANY
P.O. Box 25068
Salt Lake City, UT 84125
Bob Johnson
Phone: 801/972-3333
Facsimile: 801/972-6769
Telex: 3723464

Exhibits promoting services available from Boyles Brothers Drilling Company.

Booth No. 14

BUREAU OF LAND MANAGEMENT
2800 Cottage Way
Room E-2841
Sacramento, CA 95825
Sean E. Hagerty
Phone: 916/978-4735
Facsimile: 916/978-4715

Photographs, charts, and handouts on geothermal development on federal leases in the western states.

Booth No. 52

CALIFORNIA ENERGY COMMISSION
1516 Ninth Street
MS 43
Sacramento, CA 95814
Michael Smith
Phone: 916/324-3502
Facsimile: 916/327-1879

A pictorial display of the California Energy Commission's Geothermal Program.

Booth No. 56

CFM - SF, INC.
1110 Burnett Avenue
Suite F
Concord, CA 94520
Tim Kamczyc
Phone: 415/685-2711
Facsimile: 415/685-2711

Bailey Controls - Complete line of field and control room instruments.
KAY-RAY-STEAM QUALITY METER. REXA Corp. - Expert Positioning Actuators.

Booth No. 22

CENTRON CORPORATION
100 Airport Road
Mineral Wells, TX 76067
Russell P. Johnson
Phone: 817/325-1341
Facsimile: 817/325-9681

Corrosion resistant fiberglass piping systems for geothermal applications.

Booth Nos. 43, 44, & 45

COMPLETION TOOL COMPANY
4265 San Felipe
Suite 400
Houston, TX 77027
Ken Whanger
Phone: 713/961-3336
Facsimile: 713/961-3302
Telex: 775781 CTC HOU

Completion Tool Co.'s cement inflatable PAYZONE™ Packer is the only long (20' and 40') packer designed specifically for inflation with cement and proven in hundreds of wells worldwide. They have been successfully installed in numerous geothermal wells serving as tension anchors, protection production formations from cement impairment and providing successful shoe tests by isolating wellbore annuli.

Booth No. 8

DOW CHEMICAL, USA - GAS/SPEC TECH. GRP.
P.O. Box 4641
Houston, TX 77210
David Nicholas
Phone: 713/978-3889
Facsimile: 713/978-3870
Telex: 775437

H₂S Abatement technologies and chemicals.

Booth No. 29

DOWELL SCHLUMBERGER INC.
P.O. Box 5818
Denver, CO 80217
Ron Root
Phone: 303/773-8800
Facsimile: 303/779-7926

Services for the geothermal industry. Geothermal cementing, fracturing, acidizing and chemicals.

Booth Nos. 33 & 34

EASTMAN CHRISTENSEN COMPANY
P.O. Box 14609
Houston, TX 77221-4609
Jerry Scheafer/Irene Nava
Phone: 805/834-9654
Facsimile: 805/834-2450

Downhole drilling products and services including bits, downhole tools, coring services, directional drilling systems.

Booth Number 7

ENERGYLOG CORPORATION
P.O. Box 162580
Sacramento, CA 95816
Randy Palmer
Phone: 916/452-7541
Facsimile: 916/452-5806

Portable display

Booth No. 40

EXLOG/SMITH GEOTHERMAL DIVISION
P.O. Box 1349
Healdsburg, CA 95448
Alan Frazer
Phone: 707/431-1700
Facsimile: 707/431-1705

Exlog/Smith will display state of the art hardware and software used for mud logging geothermal wells. We will also cover hydrogen sulfide abatement and hazardous atmosphere monitoring.

Booth No. 56

FLOW CONTROL DIVISION
COOPER INDUSTRIES, INC.
P.O. Box 2117
Houston, TX 77252-2117
Milton R. Winebrenner
Phone: 713/261-3407
Facsimile: 713/499-5211
Telex: 166282

Geothermal wellhead equipment and literature.

Booth Nos. 2 & 4
(outside)

FOSTER/WLG SYSTEMS DIVISION
6445 Burlington North
Houston, TX 77092
William L. Godare
Phone: 713/690-3553
Facsimile: 713/690-4344

Foster/WLG Systems Division manufacturers geothermal gate valves and wellhead components. Along with the new product manufacturing, we offer complete reconditioning and repair services and a valve exchange program. Call us for details.

Booth Nos. 18 & 19

FUJI ELECTRIC CO., LTD.
C/O Fuji Electric Corp. of America
727 W. 7th Street
Suite 235
Los Angeles, CA 90017
Hisao Ohno
Phone: 213/622-4490
Facsimile: 213/488-9382
Telex: 677318

Booth No. 27

GENERAL PROCESS CONTROLS
5673 West Las Positas
Suite 210
Pleasanton, CA 94566
George Constas
Phone: 415/847-9190
Facsimile: 415/847-9197

Masoneilan Control Valves, Vanessa Isolation Valves, Foxboro/Jordon Electric Actuators, Sparling Magnetic Flowmeters, Chessell Recorders.

Booth Nos. 2 & 3

GEYSERS GEOTHERMAL ASSOCIATION

P.O. Box 6501
Santa Rosa, CA 95406
Ted Wilmsen
Phone: 707/527-8947

The Geysers Geothermal Association is a nonprofit organization with a membership close to four hundred individuals who actively participate in the development of geothermal at The Geysers.

The exhibit features a historical collection of pictures depicting the early development of The Geysers from approximately 1900 to the early 1960's.

A video called "The Geysers," produced by the GGA in 1984 as an educational tool, showing present day Geysers development is also being shown every half hour.

Booth No. 9

GRAHAM MANUFACTURING CO., INC.

20 Florence Avenue
Batavia, NY 14020
Al Cadena
Phone: 716/343-2216
Facsimile: 716/343-1097
Telex: 71-6854142

Steam surface and direct contact condensers with associated vacuum systems.

Booth No. 39

H & H OIL TOOL CO., INC.

1000 Church Road
Rio Vista, CA 94571
Joe Turk
Phone: 707/374-6493
Facsimile: 707/374-6192

H & H Oil Tool Company, Inc. rent a wide range of equipment to geothermal, and oil and gas companies for use in well servicing, workover, downhole fishing, completion, drilling and exploration activities both on and offshore, throughout the Western United States. We currently have nine stores in California and six stores in the Rocky Mountains. H & H started servicing the Geothermal Industry in 1971.

Booth No. 16

HARDING LAWSON ASSOCIATES
7655 Redwood Boulevard
Novato, CA 94948
Paul Brophy
Phone: 415/899-7393
Facsimile: 415/892-1586

Harding Lawson Associates involvement in the Geothermal Industry includes: Geologic, geophysical and geochemical evaluation of geothermal systems - reservoir analysis - drilling management - environmental assessments.

Booth No. 41

HOT-HEAD, INC.
P.O. Box 840305
Houston, TX 77284-0305
James Coston
Phone: 713/550-2100
Facsimile: 713/859-7396
Telex: 324489 HOT-HED HOU

The Hot-Hed is a nontoxic solid fuel controlled heat source. It produces uniform concentric preheat and postweld heat treatment for field welding of casing heads to casing. The Hot-Hed casing head installation system produces superior welds even in adverse weather conditions.

Booth No. 17

HUGHES TOOL COMPANY
1623 Goodyear Avenue
Suite B
Ventura, CA 93003
Wayne R. Hall
Phone: 805/644-0324
Facsimile: 805/644-0759

Hughes Tool Company will highlight rock bits for geothermal drilling and video of "Bit Action on Bottom."

Booth No. 38

JOHNSTON PUMP COMPANY
3215 Producer Way
Pomona, CA 91768
Jorge Gonzalez
Phone: 714/594-9959
Facsimile: 714/594-2609

Geothermal Service Division - The most experienced manufacturer of downhole production pumps. Specialists in building, repairing and servicing all types of vertical turbine pumps for geothermal service including production, reinjection, booster, hydrocarbon, condensate, and cooling tower.

Booth No. 20

LONGYEAR COMPANY
32 Stokes Drive
P.O. Box 1000
Dayton, NV 89403
John M. Mastor
Phone: 702/246-0297
Facsimile: 702/246-3208

Photos, brochures, and videos of wireline core drilling equipment used for temperature gradient holes.

Booth Nos. 49, 13 & 14
(13 & 14 outside)

M-I AIR DRILLING
M-I DRILLING FLUIDS CO.
P.O. Box 42842
Houston, TX 77242
Roy M. Wolke
Phone: 713/750-2525
Facsimile: 713/750-2563
Telex: 166854

Photographs of equipment, brochures, and T.V. monitor. One large compressor (40' long x 10" wide).

Booth No. 6
(outside)

MIDWAY FISHING TOOL, DIVISION
H & H OIL TOOL
P.O. Box 11038
Santa Rosa, CA 95406
Randy Fulcher
Phone: 707/585-1457
Facsimile: 707/585-1513

Midway Fishing Tool specializes in all types of well bore drilling stem recovery. Midway also specializes in well completion equipment line hangers, tie back receptacles, all sizes, types and grades etc. Midway has been successful in Geothermal operation for the last 15 years.

Booth No. 25 & 26

MITSUBISHI HEAVY INDUSTRIES AMERICA, INC.
630 Fifth Avenue, 34th Floor
New York, NY 10111
Haruo Yamanaka
Phone: 212/969-9000
Facsimile: 212/262-3301
Telex: 127756

Booth No. 55

NALCO CHEMICAL COMPANY
4310 N. 75th Street
Scottsdale, AZ 85251
John P. Staub
Phone: 602/941-3915
Facsimile: 602/945-1791

Chemical treatment program control and monitoring systems.

Booth No. 10

NASH ENGINEERING COMPANY
310 Wilson Avenue
P.O. Box 5130
Norwalk, CT 06856
Arthur B. Ward
Phone: 203/852-3724
Facsimile: 203/852-3988

Describing Nash equipment: Condenser exhausters consisting of steam ejectors, stainless steel vacuum pumps, and hybrid systems.

Booth No. 51

OLIN WATER SERVICES
9393 W. 110 Street
Overland Park, KS 66210
Harry Gray
Phone: 913/451-3100
Facsimile: 913/451-6391

Olin Waters Services' display will highlight services, products and equipment related to geothermal steam and cooling water systems. Please stop by for free technical papers and related information.

Booth No. 53

ORMAT ENERGY SYSTEMS, INC.
610 East Glendale Avenue
Sparks, NV 89431-5811
Ami Yarimi
Phone: 702/356-9111
Facsimile: 702/356-9125

Ormat Group of Companies, suppliers of modular power plant systems and developers of geothermal power plant projects.

Booth Nos. 6, 11, & 12
(11 & 12 outside)

PACIFIC INSPECTION COMPANY
P.O. Box 10568
Bakersfield, CA 93389
Hershel White
Phone: 805/589-2111
Facsimile: 805/589-6388

Oil country tubular inspection display.

Booth Nos. 50, 5 & 7
(5 & 7 outside)

PRUETT INDUSTRIES
8915 Rosedale Highway
Bakersfield, CA 93312
Jim Ruppel or Eddie Pruett
Phone: 805/589-2768
Facsimile: 805/589-3268
Telex: 4992440 PRUETT INT

Pruett Industries presents its temperature/pressure/and spinner logging ability with no heat restrictions with the utilization of the capillary tubing system. Monitoring equipment and chemical injection systems.

Booth No. 13

SMITH INTERNATIONAL
5221 Stine Road
Bakersfield, CA 93313
Jeff Vincent
Phone: 805/834-6464
Facsimile: 805/831-6061

Booth No. 42

STONE & WEBSTER ENGINEERING CORP.
7139 Koll Center Parkway
Suite 100
Pleasanton, CA 94566
James D. Purvis, Jr.
Phone: 415/426-2001
Facsimile: 415/426-2010

Stone & Webster provides professional engineering, construction and consulting services to industry, utilities and government.

Booth No. 46

TONTO DRILLING SERVICES
2200 South 4000 West
Salt Lake City, UT 84120
George McLaren
Phone: 801/974-0645
Facsimile: 801/973-2994

Photographic, video, and equipment display of drilling techniques used in exploration for geothermal resources.

Booth Nos. 4 & 5

TOSHIBA INTERNATIONAL CORPORATION
350 California Street
Suite 700
San Francisco, CA 94104
Yuji Saito
Phone: 415/434-2340
Facsimile: 415/986-5630
Telex: W.U. 03-4484

Toshiba has a long history of providing quality equipment and service in the field of geothermal energy. Toshiba's steam turbine generators are responsible for over 70% of the total MW output in The Geysers field. Toshiba is looking to the future with longer life equipment and high-tech computerized control monitorization.

Booth No. 1

UNITED LABS
6001 Orchard Station Road
Petaluma, CA 94952
Steve Holmstrom & Terry Eaton
Phone: 1-800-323-2594

United Labs, 25 years making the work place a safe place. Sales of industrial chemicals; specialties are solvents and corrosive coatings

Booth Nos. 31 & 32

UNOCAL GEOTHERMAL
P.O. Box 6854
Santa Rosa, CA 95406
J. Erick Mack, Jr.
Phone: 213/977-6336
Facsimile: 213/977-5185
Telex: 677593

Animated and photographic description of UNOCAL geothermal exploration and development in the U.S. and overseas.

Booth No. 15

WATER SERVICES OF AMERICA, INC.
8165 West Tower Avenue
Milwaukee, WI 53223
M. Massopust
Phone: 414/354-6470
Facsimile: 414/354-9007

Booth Nos. 23 & 24

WILLIAMS TOOL COMPANY
P.O. Box 6155
Fort Smith, AR 72906
John Williams
Phone: 501/646-8866
Facsimile: 501/646-3502
Telex: 536016 Williams AR UD

Williams rotating drilling heads and accessories, sales, rentals and service since 1968. Come by booth #23 and #24 for an on hands inspection of the latest in rotating control heads.

Booth No. 11 & 12

YEARY & ASSOCIATES, INC.
1900 Bates Avenue
Suite H
Concord, CA 94520
Peter Guymer
Phone: 415/676-4440
Facsimile: 415/676-1030

Valves and piping specialties.

**GEOHERMAL RESOURCES COUNCIL
1989 ANNUAL MEETING EXHIBITS BY BOOTH NUMBER**

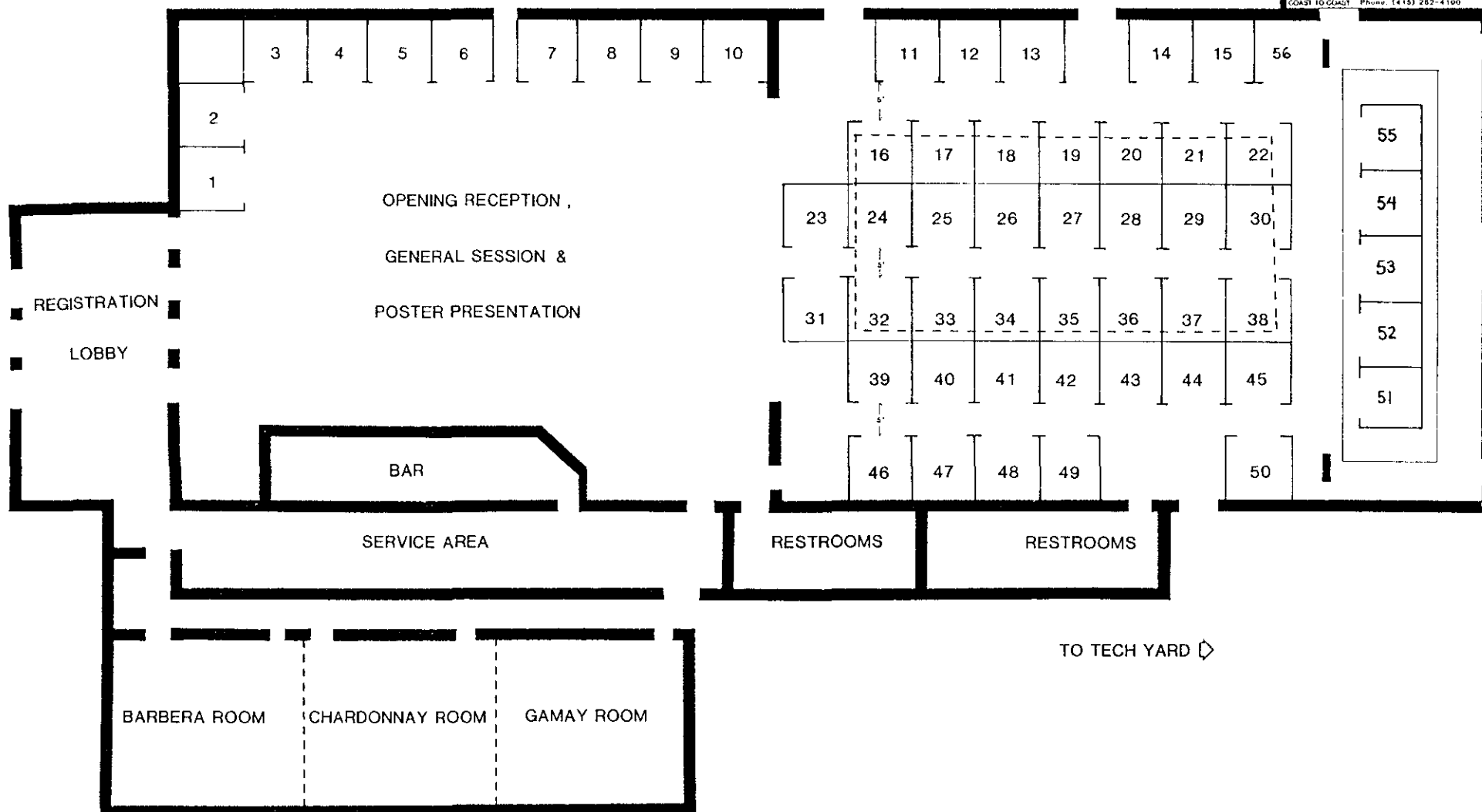
| <u>BOOTH NO.</u> | <u>COMPANY</u> | <u>BOOTH NO.</u> | <u>COMPANY</u> |
|-------------------|-------------------------------|------------------|-------------------------------|
| 1 | UNITED LABS | 22 | CENTRON CORP. |
| 2 & 3 | GEYSERS GEOTHERMAL ASSOC. | 23 & 24 | WILLIAMS TOOL CO. |
| 1 & 3 (outside) | A-Z/GRANT INTERNATIONAL | 25 & 26 | MITSUBISHI HEAVY IND. AMERICA |
| 2 & 4 (outside) | FOSTER/WLG SYSTEMS DIV. | 27 | GENERAL PROCESS CONTROLS |
| 4 & 5 | TOSHIBA INTERNATIONAL CORP. | 29 | DOWELL SCHLUMBERGER INC. |
| 5 & 7 (outside) | PRUETT INDUSTRIES | 31 & 32 | UNOCAL |
| 6 | PACIFIC INSPECTION | 33 & 34 | EASTMAN CHRISTENSEN |
| 6 (outside) | MIDWAY FISHING | 35 & 36 | ANSALDO ABB COMPONENTI |
| 7 | ENERGYLOG CORP. | 37 | BOYLES BROTHERS DRILLING CO. |
| 8 | DOW CHEMICAL | 38 | JOHNSTON PUMP CO. |
| 8 (outside) | BARTON VALVE CO. | 39 | H & H OIL TOOL CO. |
| 9 | GRAHAM MANUFACTURING | 40 | EXLOG/SMITH |
| 10 | NASH ENGINEERING | 41 | HOT-HED, INC. |
| 11 & 12 | YEARY & ASSOCIATES | 42 | STONE & WEBSTER |
| 11 & 12 (outside) | PACIFIC INSPECTION | 43, 44 & 45 | COMPLETION TOOL CO. |
| 13 | SMITH INTERNATIONAL | 46 | TONTO DRILLING |
| 13 & 14 (outside) | M-I AIR DRILLING | 47 | AMERICAN LINE BUILDERS |
| 14 | BUREAU LAND MANAGEMENT | 48 | BELILOVE CO. |
| 15 | WATER SERVICES OF AMERICA | 49 | M-I DRILLING FLUIDS |
| 16 | HARDING LAWSON ASSOCIATES | 50 | PRUETT INDUSTRIES |
| 16 (outside) | BALLEW TOOL CO. | 51 | OLIN WATER SERVICES |
| 17 | HUGHES TOOL CO. | 52 | CALIFORNIA ENERGY COMMISSION |
| 18 & 19 | FUJI ELECTRIC CO., LTD | 53 | ORMAT ENERGY SYSTEMS |
| 20 | LONGYEAR CO. | 54 | NALCO CHEMICAL |
| 21 | ASSOCIATED PIPING & ENGR. | 55 | FLOW CONTROL DIVISION COOPER |
| OUTSIDE TRAILER | GEOHERMAL RESOURCES COUNCIL | | INDUSTRIES, INC. |
| | AND NATIONAL GEOHERMAL ASSOC. | 56 | CFM - SF, INC. |

NATIONAL GEOTHERMAL ASSOCIATION
 1989 ANNUAL MEETING
 OCTOBER 1 - 4, 1989
 EL RANCHO TROPICANA HOTEL
 SANTA ROSA, CA

50'-10" x 10" BOOTHS

05/08/89

UX UNITED EXPOSITION SERVICE CO.
 390 Valley Drive
 Berkeley, California 94709
 COAST TO COAST Phone: (415) 262-4100





List of Attendees

1 - 4 OCTOBER 1989

EL RANCHO TROPICANA HOTEL
SANTA ROSA, CALIFORNIA

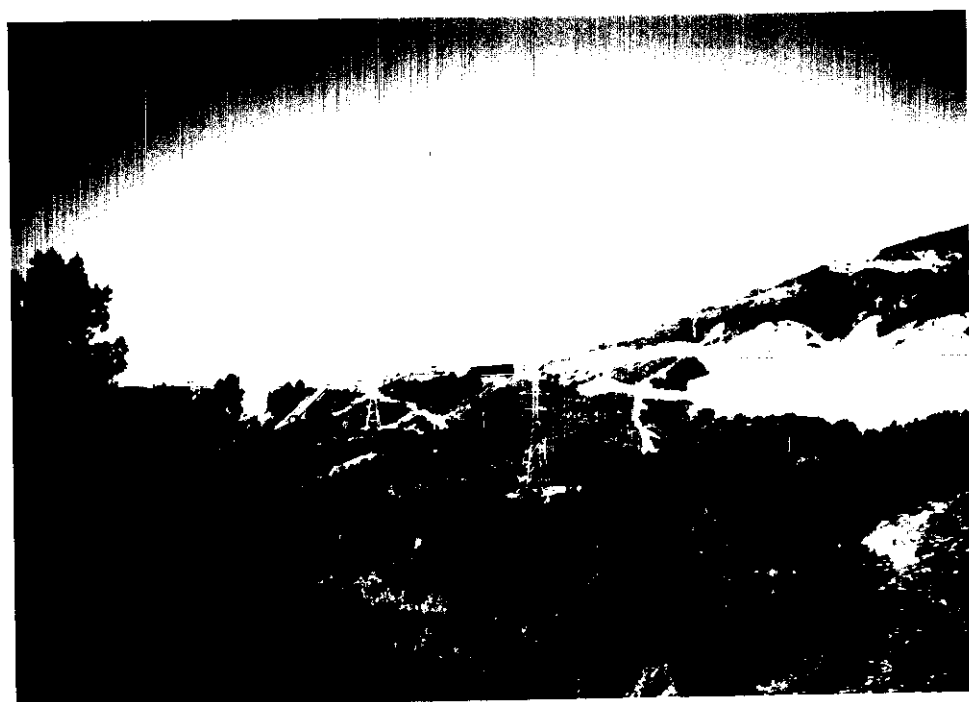




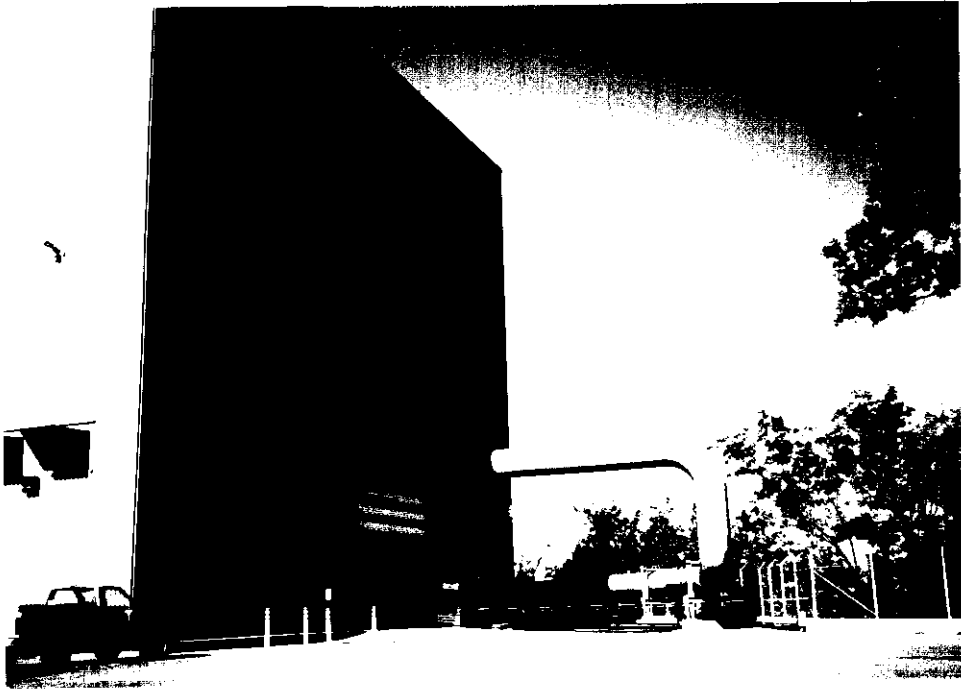
EAST GEYSERS PG & E
ADMINISTRATION CENTER



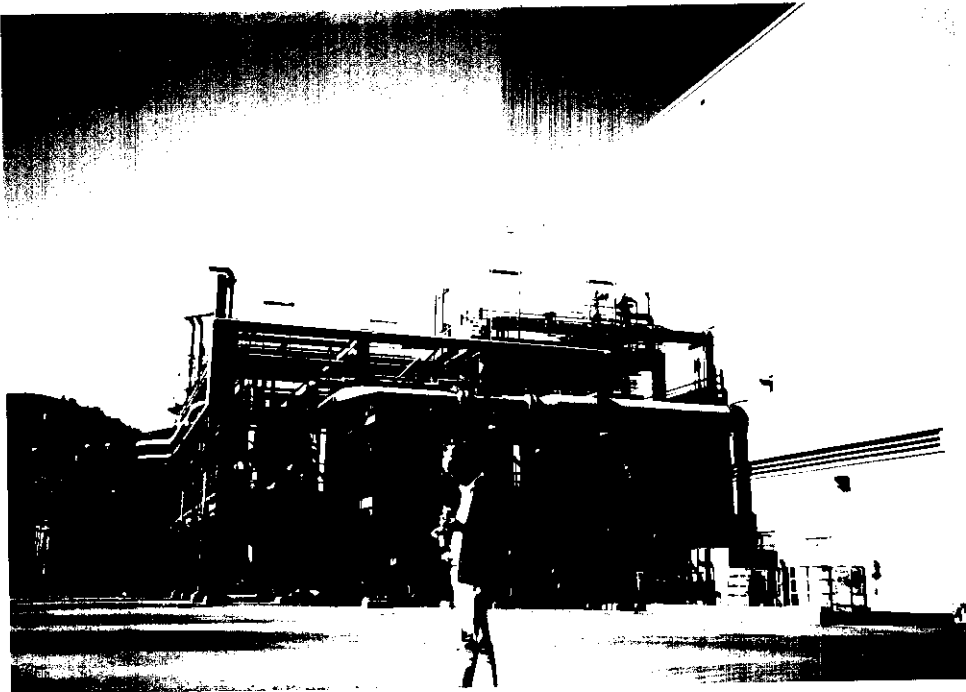
VIEW OF PG & E UNIT #18 FACILITY



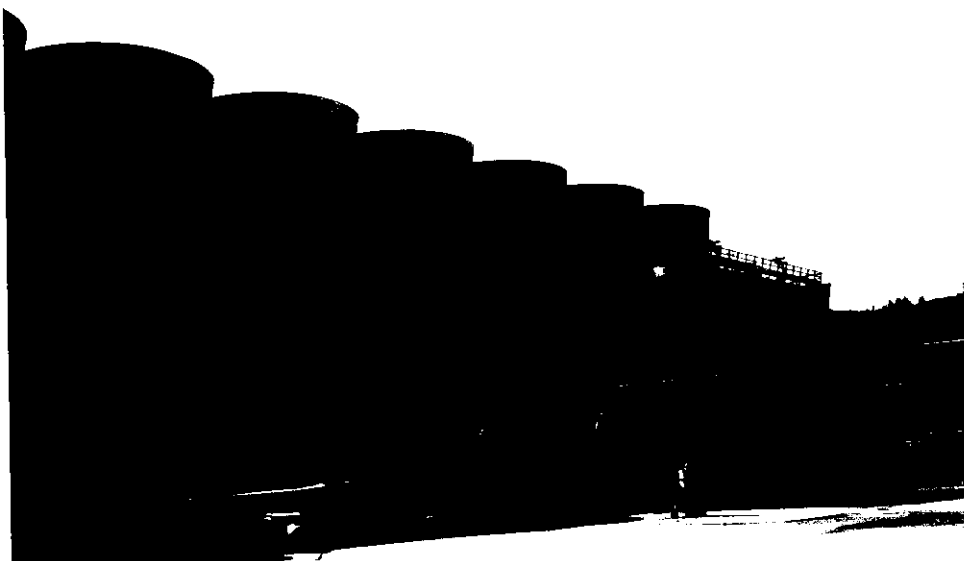
VIEW OF TRANSMISSION LINES & STEAM LINES



PG&E UNIT #18 GEOTHERMAL PLANT (GEYSERS)
- 42" INSULATED STEAM PIPELINE INTO PLANT



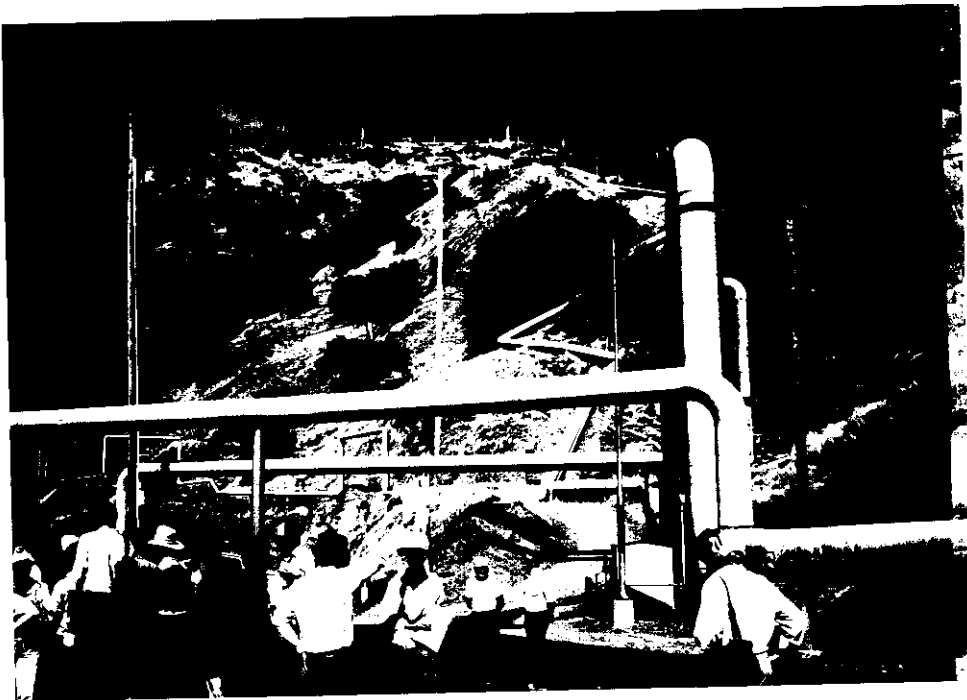
OUTLET FOR NON-CONDENSABLE GASES EXITING
TURBINE TO THE H₂S ABATEMENT SYSTEM



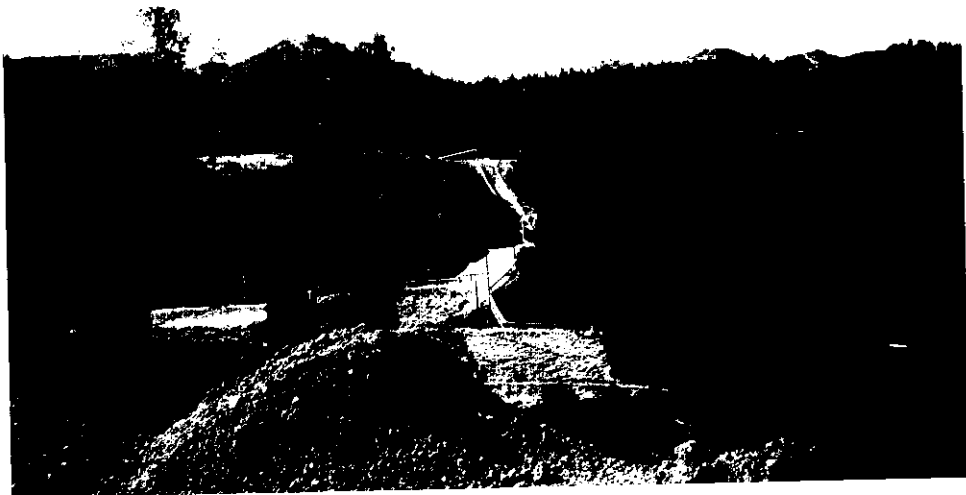
MECHANICAL DRAFT COOLING TOWER



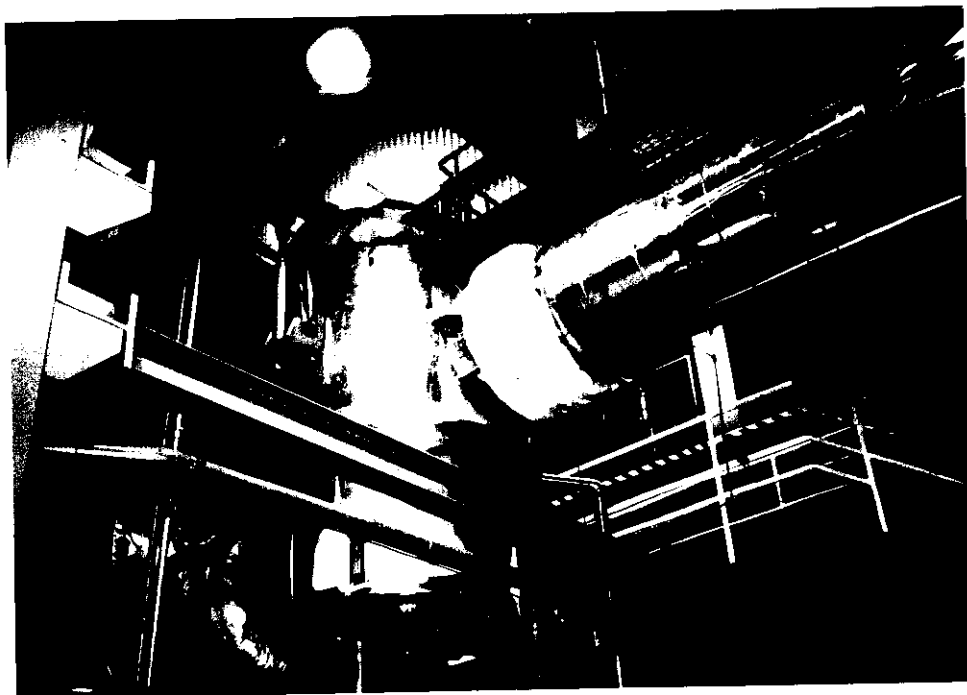
WELL FIELD AND STEAM SUPPLY LINES



STEAM PIPELINES WITH VERTICAL EXPANSION LOOPS



STEAMLINES "PAINTED" ACCORDING TO TERRAIN



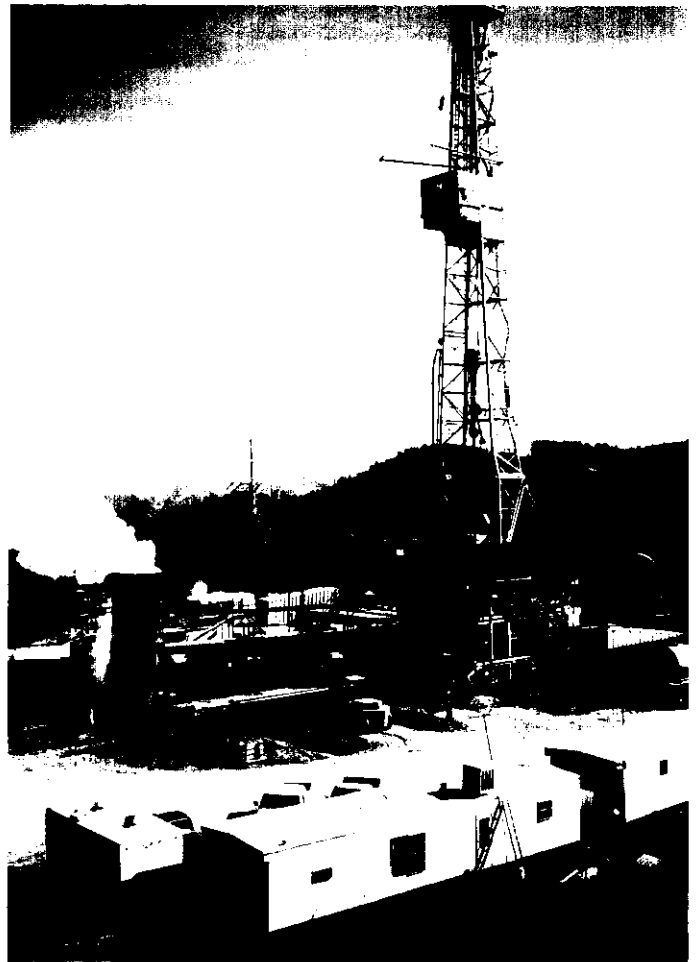
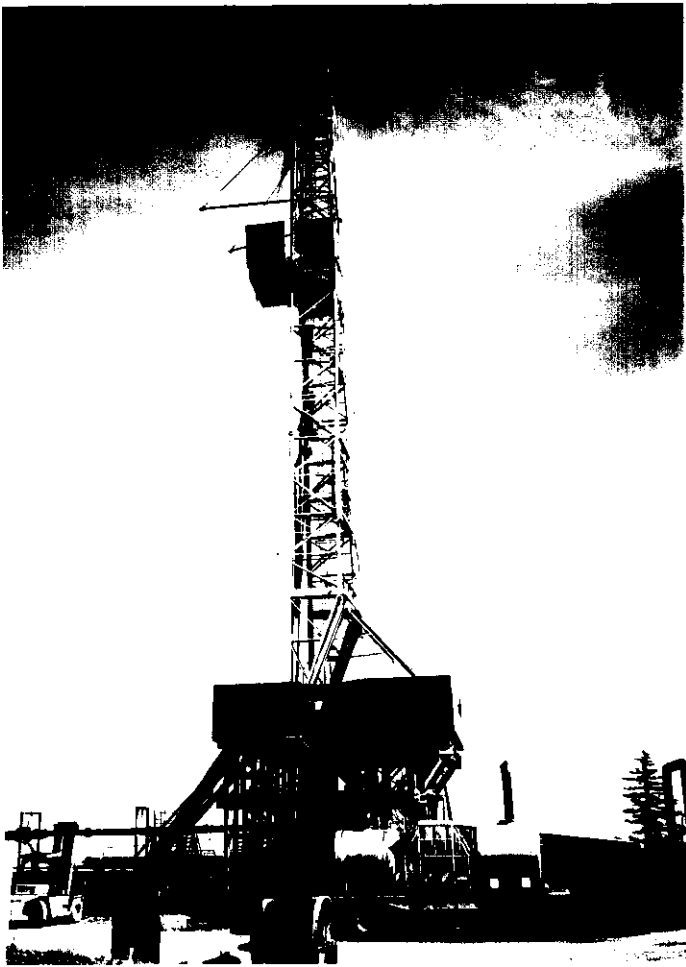
42" STEAMLIN INTO TURBINE SYSTEM



SINGLE 124 MEGAWATT TURBINE UNIT



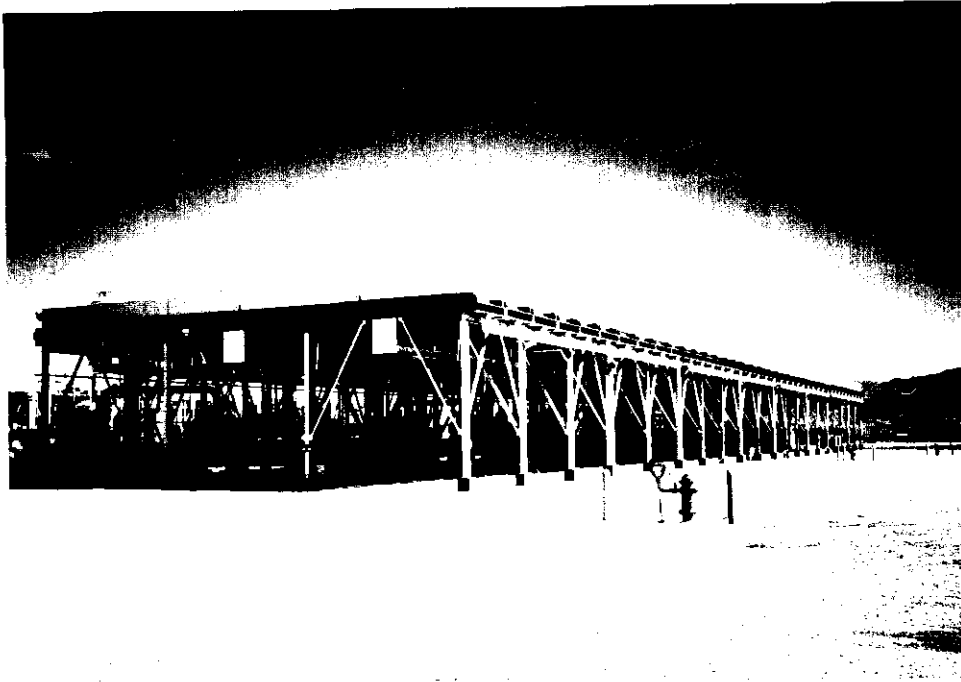
PG&E UNIT #18 CONTROL HOUSE



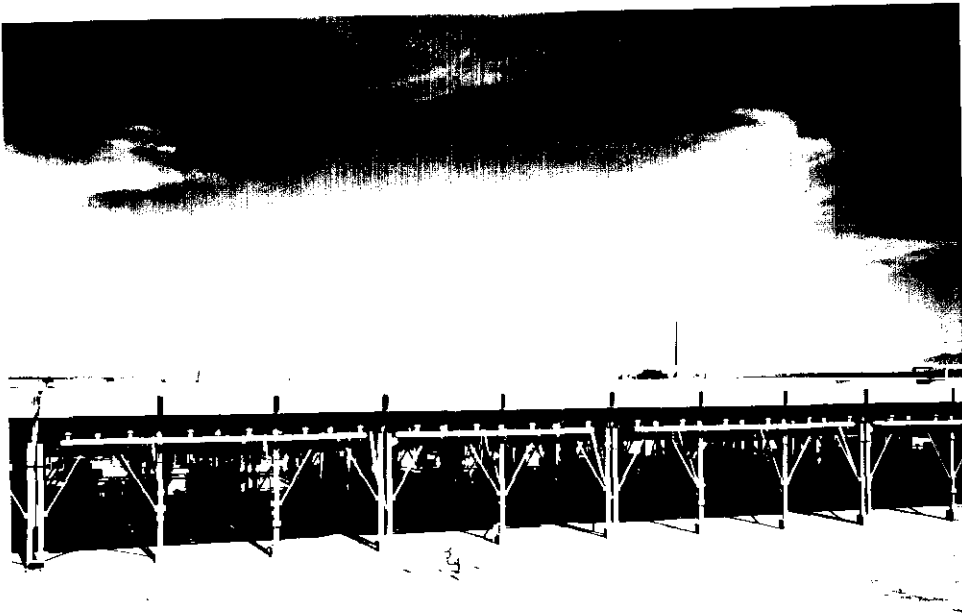
DRILLING OPERATIONS AT SANTA FE PROJECT



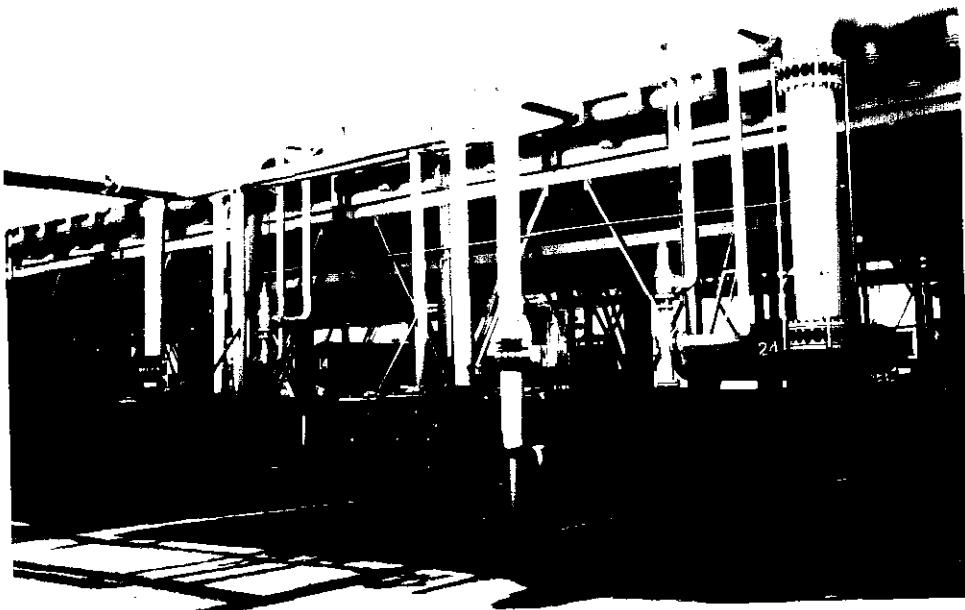
AIR DRILLING USING 'BLODIE' LINE AND
CYCLONIC MUFFLER WITH H_2S ABATEMENT



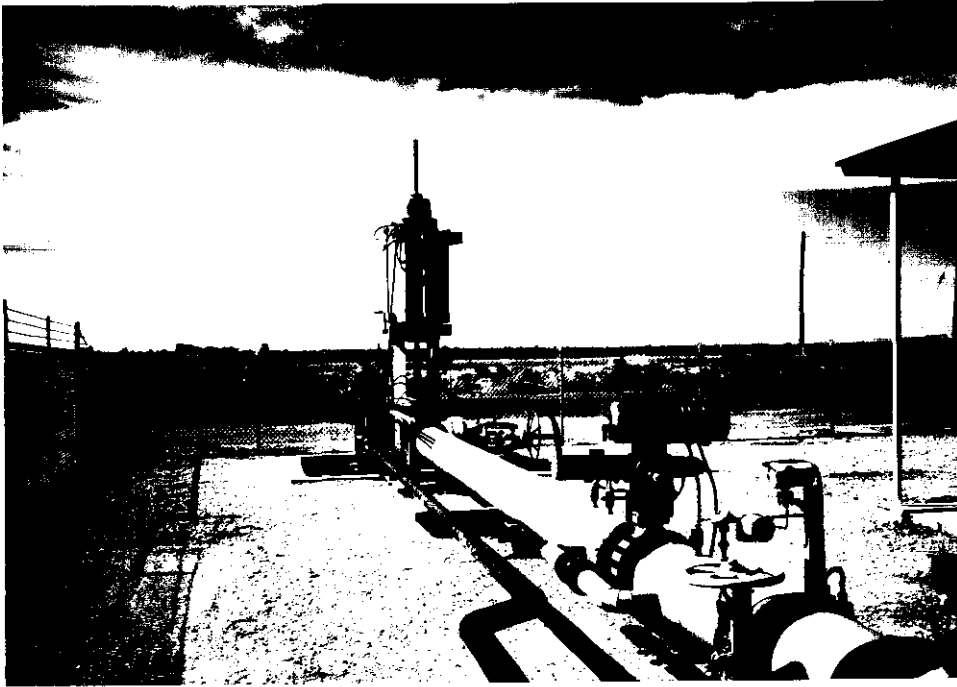
STILLWATER GEOTHERMAL FACILITY, FALLON, NEVADA



*105 AIR COOLING UNITS FOR 7 ORMAT DEC
UNITS (NOTE-EMERGENCY RELEASE VALVE STACKS)*



*BRINE LINES INTO THE ORMAT ENERGY
CONVERTER UNITS (LEVEL 1 & LEVEL 2)*



GEOTHERMAL WELL WITH ELECTRICAL PUMP
TO WITHDRAW HOT GEOTHERMAL BRINE (~340°F)



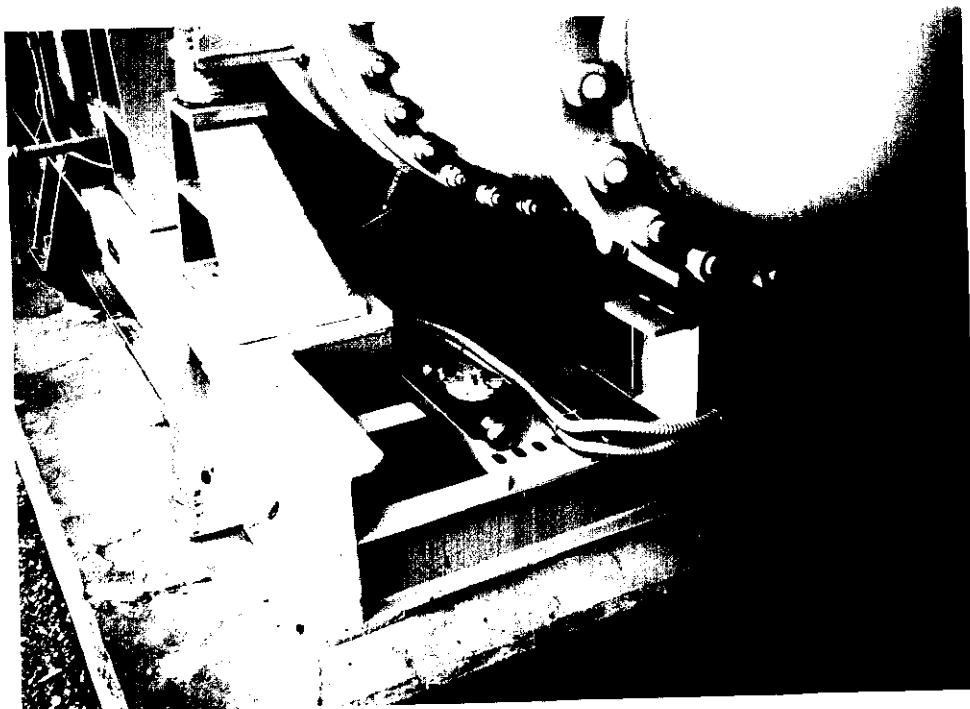
BRINE SUPPLY LINES TO DEC UNITS IN PARALLEL
WITH BRINE LINES TO THE INJECTION WELLS



NEARBY INJECTION WELL, LARGE WATER
TANK ONSITE FOR FIRE PREVENTION PURPOSES



YELLOW ISOPENTANE HOLDING TANKS WITH
BRINE SUPPLY & RE-INJECTION LINES (FOREGROUND)



ISOPENTANE LEAK DETECTOR UNIT



ELECTRICAL SUB-STATION AND STEP-UP
TRANSFORMER CONNECTING TO TRANSMISSION LINE